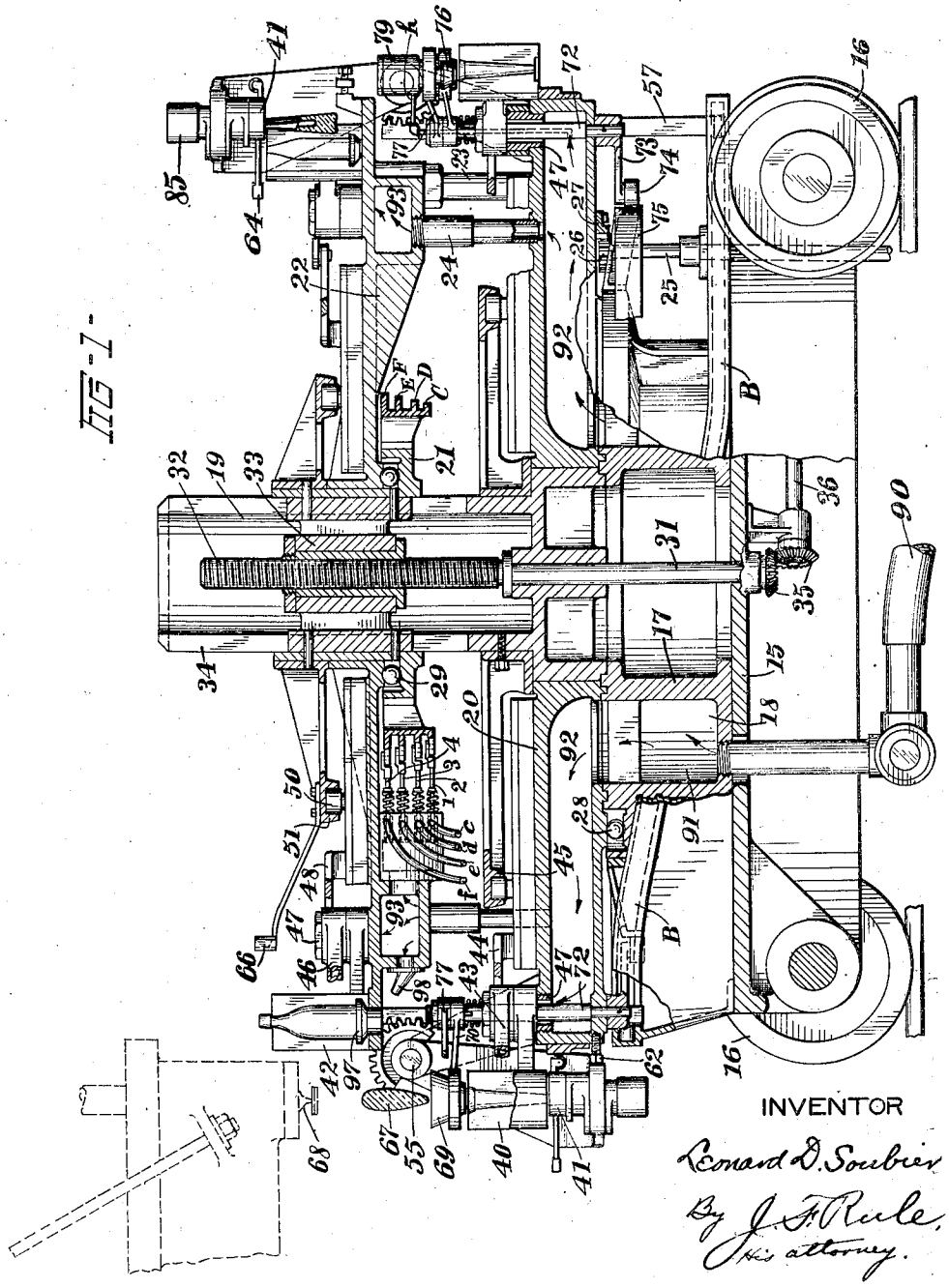
Nov. 26, 1929. L. D. SOUBIER 1,737,524

GLASS BLOWING MACHINE

Filed Dec. 29, 1922 5 Sheets-Sheet 1

FIG. 1.



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GLASS BLOWING MACHINE

Filed Dec. 29, 1922 5 Sheets-Sheet 2

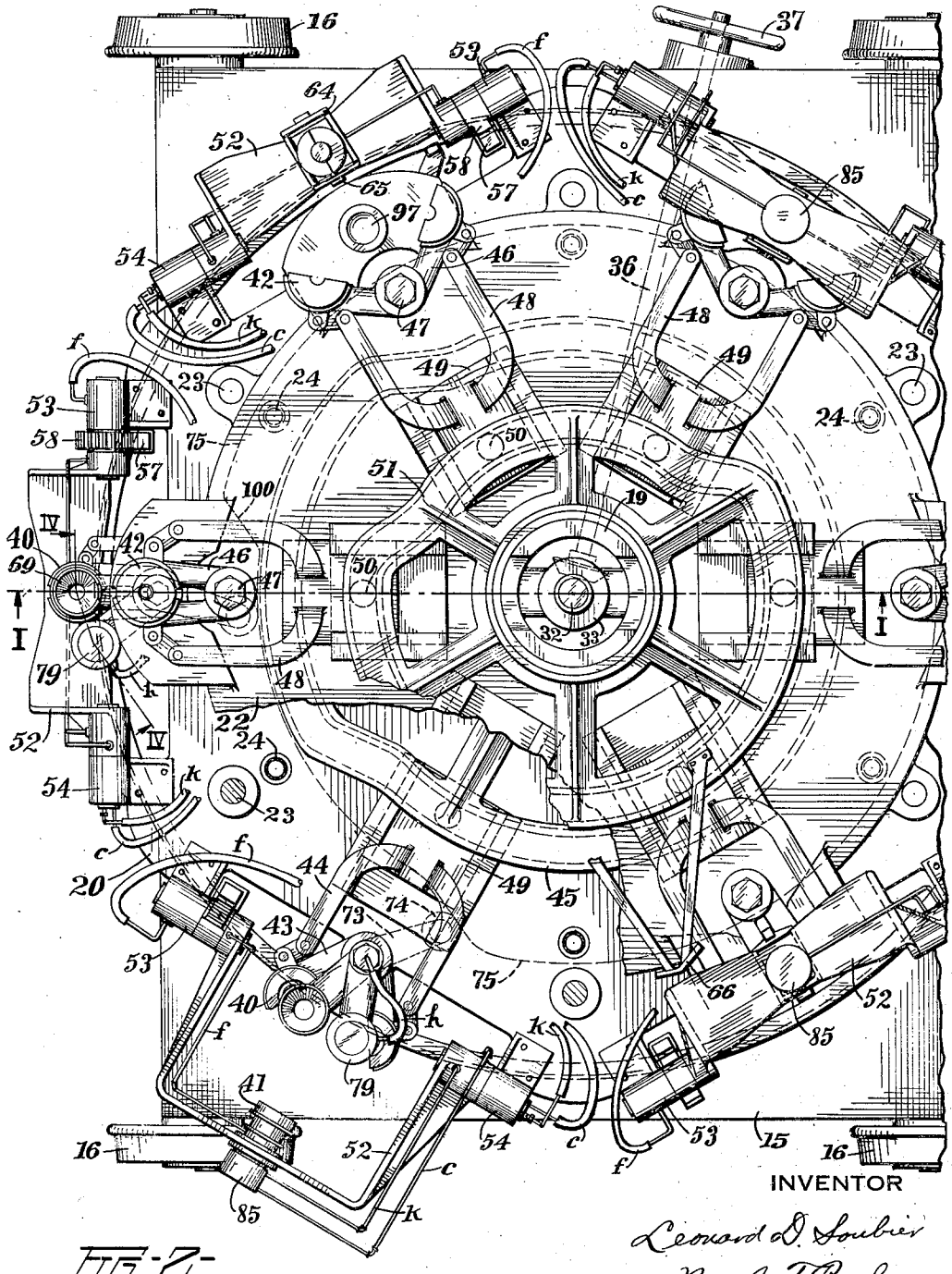

FIG-2-

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GLASS BLOWING MACHINE

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FIG-3-

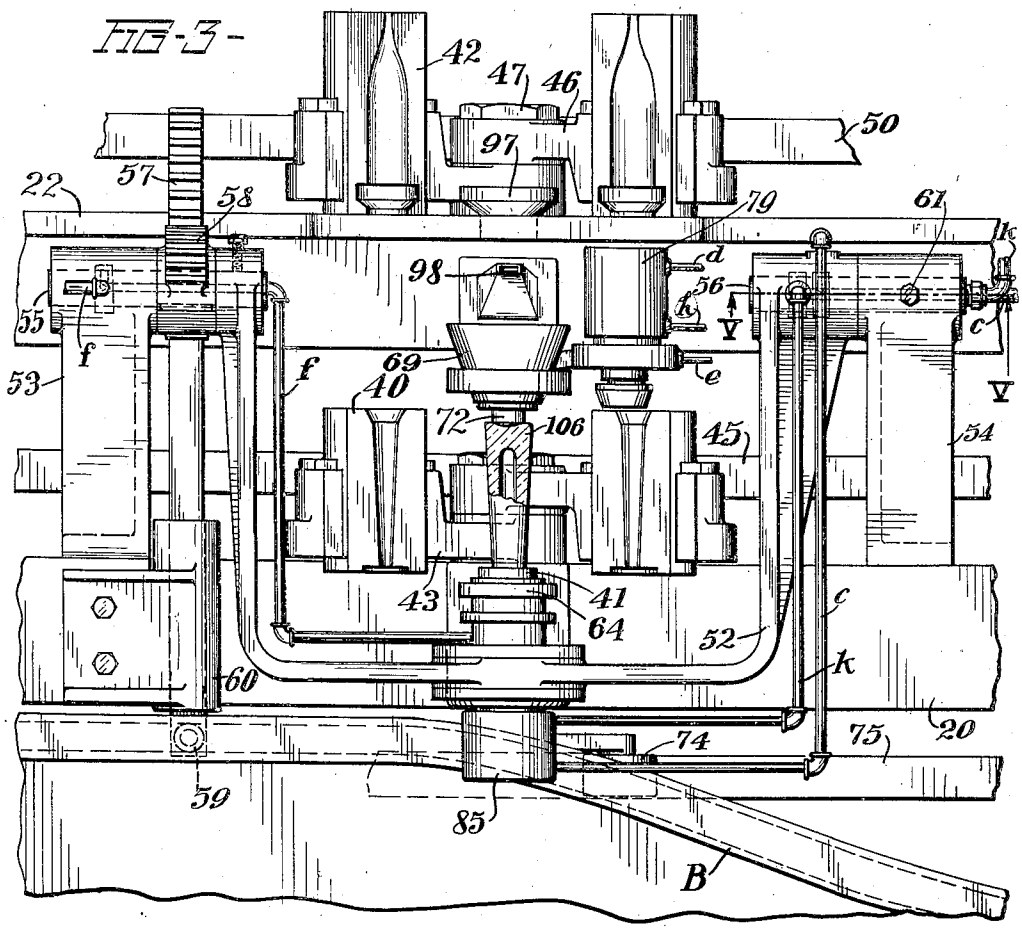
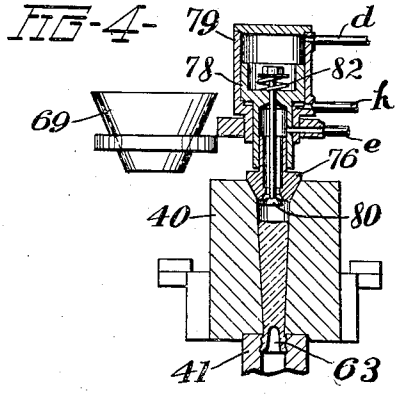


FIG-4-



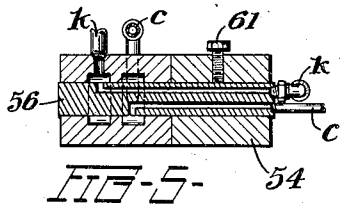


FIG-5-

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GLASS BLOWING MACHINE

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FIG-6-

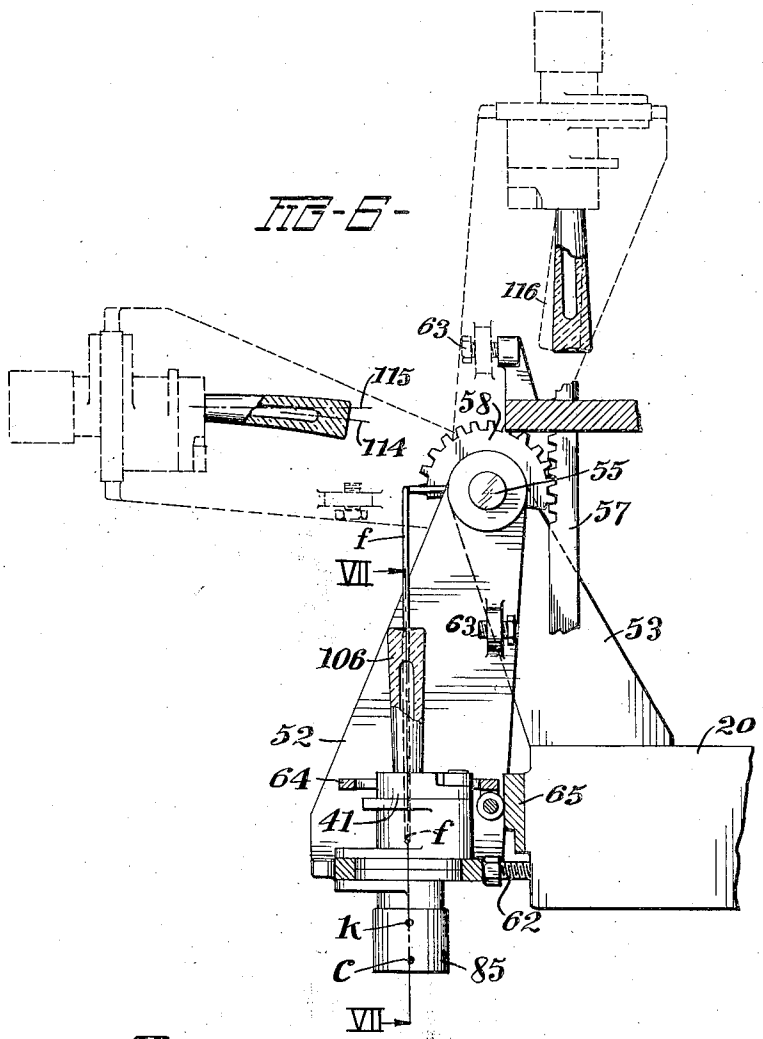
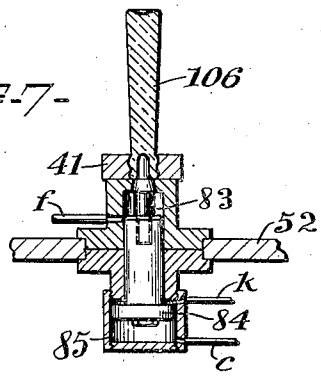


FIG-7-



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GLASS BLOWING MACHINE

Filed Dec. 29, 1922 5 Sheets-Sheet 5

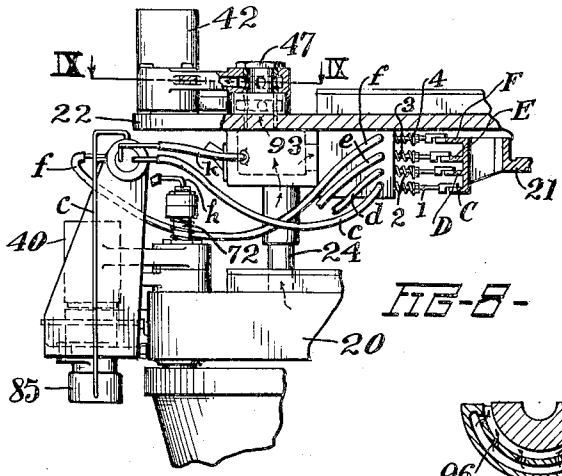

FIG-8-

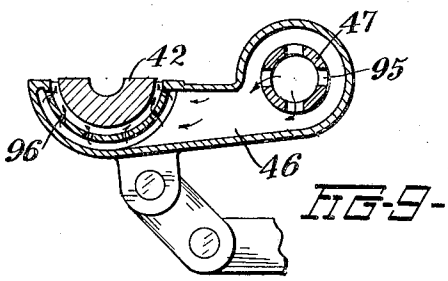

FIG-9-

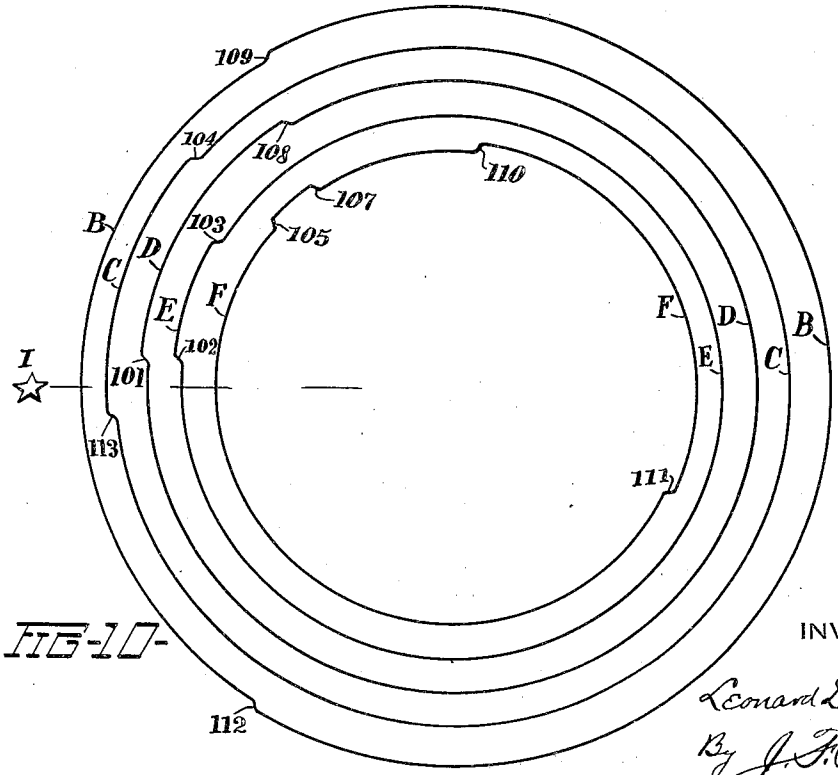

FIG-10-

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Patented Nov. 26, 1929 1,737,524

UNITED STATES PATENT OFFICE

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GLASS-BLOWING MACHINE

Application filed December 29, 1922. Serial No. 609,633.

My invention relates to automatic glass blowing machines for making bottles or other hollow glassware. The invention is herein shown as embodied in a type of machine in which a charge of glass is dropped into an inverted blank mold, partially formed therein, the blank mold then opened leaving the bare blank supported in the neck mold, the blank then inverted by inverting the neck mold, the finishing mold closed around the blank, and the article blown to its finished form therein.

In machines of this type, it has been the practice in inverting the bare blank, to swing it downward about a horizontal axis, the neck mold being between said axis and the blank so that the outer or free end of the blank is swung through a rather large arc and at considerable speed. There is therefore a tendency for the blank of plastic glass to be distorted and unduly stretched just below the neck mold and a further tendency to be thrown by its intertia or momentum beyond a pendant vertical position when the neck mold is arrested at the completion of the inverting movement. As a result, the blank is not always accurately centered in the finishing mold when the latter closes, and when the bottle is blown to its finished form there is a consequent lack of uniformity in the thickness of the walls and particularly of the shoulder and bottom of the bottle.

An object of my invention is to provide a practical machine of the type indicated which will be free from the above objection. For the attainment of this and other objects, I provide a machine in which the neck mold is carried by a blank inverting frame mounted to swing about a horizontal axis and so arranged that the bare blank before the inverting movement projects upward from the neck mold toward said axis, the free end of the blank being comparatively near said axis. The arrangement is such that the blank has comparatively little momentum imparted thereto during the inverting movement.

A further object of the invention is to provide an improved arrangement for distributing the air used for cooling the molds, blowing the blanks and for other purposes.

Other objects of the invention will appear hereinafter.

In the accompanying drawings:

Figure 1 is a part sectional elevation of a machine constructed in accordance with my invention.

Figure 2 is a plan view of the machine, parts being broken away.

Figure 3 is an elevation on a larger scale of one of the heads or units.

Figure 4 is a section taken at the line IV—IV on Figure 2, but with the blow head in operative relation to the mold.

Figure 5 is a section at the line V—V on Fig. 3.

Figure 6 is a part sectional elevation showing the blank inverting frame in its normal or lowered position and also showing it in broken lines in an intermediate and an inverted position.

Figure 7 shows the neck mold and plunger, being a section taken at the line VII—VII on Figure 6, but before the initial blowing of the blank.

Figure 8 is a detail of parts shown in the left hand portion of Fig. 1, and shows particularly various air connections.

Figure 9 is a section at the line IX—IX on Fig. 8, showing a mold-carrying arm and means for cooling the mold.

Figure 10 is a diagrammatic view of the cam controlling the inverting movements of the neck mold and cams for actuating the various air valves.

The machine is mounted on a base 15, having wheels 16. On the base 15 is supported a stationary casting 17, shaped to form an annular chamber 18, referred to hereinafter. Supported on the casting 17 is a central stationary column 19. The mold carriage comprises a lower blank mold table 20, and an upper finishing mold table 22. The upper and lower mold tables are connected by posts 23 and by hollow telescoping posts 24.

The mold carriage is rotated continuously about the vertical column 19 as an axis, the driving power being transmitted through a drive shaft 25, having a pinion 26 running in mesh with an annular gear 27 on the carriage. The blank mold table 20 runs on roller

bearings 28 on the casting 17 and the finishing mold table 22 runs on roller bearings 29.

The finishing mold table 22 is adjustable up and down relative to the blank mold table to adapt the machine for use with molds of different lengths. For this purpose a vertical adjusting rod 31 is journalled for rotation in the vertical column 19 and is formed with a screw threaded portion 32 threaded in a head 33, which is adjustable up and down in the column 19. The latter is provided with vertical slots 34 forming guideways for the head 33. The shaft 31 is connected through gears 35 to a horizontal shaft 36 provided with a hand wheel 37 (Fig. 2). By rotating this hand wheel, the head 33 is adjusted up and down and carries with it a cam plate 21 which supports the upper mold table through the bearings 29.

A plurality of heads or units are supported on the mold carriage to rotate therewith, each comprising a blank mold 40, a neck mold 41, a finishing mold 42, mechanism for actuating the molds, and means for controlling the several blowing operations. As all said heads are alike, a description of the mechanism comprised in one head or unit will suffice for all.

The finishing mold 42 comprises horizontally separable sections carried by arms 46 mounted to swing about a pivot 47. The arms 46 are connected by links to a yoke 48, connected to a slide block 49 carrying a cam roll 50 which runs on a stationary cam 51 connected to the head 33. The cam 51 operates through the connections just described to open and close the finishing mold. The mechanism for opening and closing the blank mold 40 may be substantially like that just described for operating the finishing mold, and comprises arms 43, on which the blank mold sections are carried, said arms having operating connections with a yoke 44 actuated by a stationary cam 45 fixed to the center column 19.

The neck mold 41 is carried on a U shaped inverting frame 52 mounted to swing about a horizontal axis from its normal or lowered position shown in full line in Fig. 6 to an inverted position shown in dotted lines in said figure. The inverting frame 52 is supported in vertical standards 53 and 54 on the blank mold table 20. One arm of the frame 52 is keyed to a shaft 55, journalled in the arm 53. The other arm of the frame 52 is journalled on a shaft 56 fixed by a holding screw 61 in the standard 54.

The frame 52 is rotated by means of a rack 57 in mesh with a gear segment 58 keyed to the shaft 55. The rack bar 57 is mounted to reciprocate vertically in a guide 60 and carries at its lower end a roll 59 running in a stationary cam track B. The inverting frame is arrested in its downward movement and positioned by an adjustable stop 62 on the table 20. In its upward movement the inverting frame is arrested by an adjustable stop 63 (Fig. 6). The opening and closing movements of the neck mold sections may be effected by the usual or any approved means. As shown, a frame 64 (Fig. 6) is actuated by stop 65 to close the neck mold as the inverting frame completes its downward movement. When the frame 52 is inverted, the frame 64 is actuated in the reverse direction to open the neck mold by means of a stationary cam 66 (Fig. 1) in the path of the frame 64.

Mold charges or gobs 67 (Fig. 1) of plastic glass, preferably supplied from an automatic gob feeder 68, are dropped through funnel guides 69 into the blank molds 40. Each funnel guide is carried by an arm 70 fixed to a vertical rock shaft 72 journalled in the lower mold table. The lower end of the rock shaft is provided with a rock arm 73 carrying a roll 74 running on a stationary cam 75. A blowing head 76 and its actuating motor 79 are carried by an arm 77, also keyed to the rock shaft 72. It will be noted that when the funnel 69 is in register with the blank mold, the blowing head is out of register, but when the shaft 72 is rocked to swing the blow head into position, the funnel is carried to one side of the mold.

The blowhead 76 (see Fig. 4) is connected to the piston 78 of an air motor 79 carried on the rock arm 77. While the blowhead 76 is over the mold, it is moved to and from the mold by the air motor. The piston is moved upward by air supplied through a pipe "K", connected to a source of constant air pressure. The piston is moved downward by air intermittently supplied through a pipe "*d*".

After the charge of glass has been dropped into the mold and the blowhead 76 brought into position over the mold, air is supplied through a pipe "*e*" to the blow head. The air pressure opens a valve 80 against the tension of a valve closing spring 82 and applies air pressure to the glass within the mold, thereby compacting the glass in blank mold and neck mold. An initial blow opening is formed in the neck of the blank mold by means of a plunger 83 (see Fig. 7) connected to the piston 84 of an air motor 85 carried by the inverting frame 52.

Referring to Fig. 6, it will be noted that the bare parison supported in the neck mold projects towards the axis about which it swings while being inverted. It is thus comparatively close to said axis. As a result, the momentum of the blank due to the inverting movement is small as compared with the usual arrangement in which the neck mold is between the blank and the axis or rotation and the blank projects outward from the neck mold away from the axis. In the present arrangement, the blank during its inverting movement is being carried upward instead of downward, so that the action of gravity op-

poses or counteracts the tendency of the blank to be thrown by momentum out of normal position and further, in this arrangement the blank will not be stretched during its inversion but will hold its shape until brought upright to a pendant position and then it will be gradually elongated through the action of gravity. Thus, as indicated in Figure 6, gravity tends to pull the blank downward and bend its axis from the horizontal position 115 to the downwardly inclined position 114. This tendency is opposed by the momentum of the upwardly moving blank. If the glass is in such condition that it is pulled by gravity to the dotted line position 116 when the inverting movement is completed, the momentum of the blank will be sufficient to carry it to the full line position when the inverting frame is arrested.

The air pressure system by which air under pressure is supplied for blowing the glass, cooling the molds and operating the air motors, will now be described:

Referring to Figure 1, a supply of air under pressure is maintained through a pipe 90 opening into an annular chamber 91 in the casting 17. This chamber is in constant communication with radial channels 92 in the rotating mold table 20. Air is conducted from the channels 92 through the telescoping pipes 24 to an annular chamber 93 in the upper mold table 22. Air for cooling the finishing molds 42 (see Figs. 8 and 9) is supplied from the chamber 93 through the hollow pivot 47 and through lateral openings 95 therein to the hollow arms 46 which carry the finishing mold sections. Said arms are provided with openings or nozzles 96 through which air is directed against the mold sections. The blank molds 40 are in like manner cooled by air supplied through the hollow pivot rods 47 (see Fig. 1) and the hollow arms 43. The pivot rods 47 are concentric with and surround the rock shafts 72. Air for cooling the finishing mold bottoms 97 (see Figs. 1 and 3) may be supplied through nozzles 98 connected with the chamber 93.

Referring to Figs. 1 and 8, the stationary casting 21 is formed with cams C, D, E and F. These cams operate valves 1, 2, 3 and 4 to connect air lines *c*, *d*, *e* and *f* respectively with the air chamber 93. The air line *c* leads through the pivot shaft 56 of the inverting frame (see Figs. 3, 5, 6 and 7) and to the outer end of the piston motor 85 which operates the plunger 83. The plunger is projected into the neck mold and held therein whenever air is supplied through the line *c*. The plunger is retracted by air supplied through an air line *k* constantly connected to the air chamber 93 (see Figs. 3, 7 and 8).

The air line *d* extends to the outer end of the air motor 79 (Fig. 4) and supplies pressure for lowering the blow head. The constant pressure line *h* leads from the air motor 79 to the rock shaft 72 and downward through said rock shaft to the pressure chamber 92, as shown at the right hand side of Fig. 1. The air line *e* leads to the blow head 76 (Fig. 4) for supplying air therethrough. The air line *f* leads from its valve 4 (Fig. 1) to standard 53 (Figs. 2 and 3) through shaft 55 and to the neck mold (Fig. 7) for supplying air to blow the blank.

The operation may be summarized as follows, reference being had particularly to Figure 10, which illustrates diagrammatically the cams B, C, D, E and F and indicates the order in which are performed the several operations controlled by said cams. The mold carriage rotates continuously in a clockwise direction. As a blank mold passes the charging station I (Figs. 2 and 10) a gob 67 (Fig. 1) is dropped through the funnel guide 69 into the mold, the guide at this time being in register with the blank mold which is in its lowered, closed position. Immediately after the charge has been received in the mold, the cam 75 operates at the point 100 (Fig. 2) to rock the shaft 72 and swing the blow head 76 over the mold.

The cam D now operates at the point 101 (Fig. 10) to supply air to the motor 79 (Fig. 4) and lower the blow head 76 onto the mold. At about the same time the cam E operates at the point 102 to supply air through the blow head for compacting the glass in the blank mold and neck mold. This air pressure is continued for a short interval and then released at the point 103. The cam C now operates at the point 104 to release the air pressure from the outer end of the motor cylinder 85 (Fig. 7), permitting the plunger 83 to be withdrawn by the pressure supplied through pipe *k*. At the same time the cam F operates at the point 105 to supply a puff of air to the initial blow opening left in the glass by the plunger 83 and blows the parison 106 to the hollow form shown in Fig. 6. This blowing is discontinued at the point 107. The cam D now operates at the point 108 to close the valve 2 and cut off the air supply through line *d*, permitting the blow head to be withdrawn by air pressure supplied through line *h*. The cam B now commences to operate at point 109 to swing the inverting frame 52 upward to invert the blank and bring the blank to a pendant position between the open finishing mold sections. The finishing mold closes around the blank and the cam F operates at the point 110 to again supply air through line *f* whereby the parison is blown to its finished form. The air pressure is maintained until the cam F operates at the point 111 to shut off the supply. After the bottle has thus been blown, the finishing mold is opened and the bottle discharged. After this, the inverting cam B operates at the point 112 to swing the inverting frame downward, whereby the blank mold is positioned for receiving the

next charge. The cam C operates at the point 113 to supply air through the line *c* and project the plunger 83 into the neck mold before the charging station I is reached.

Modifications may be resorted to within the spirit and scope of my invention.

What I claim is:

1. In a glass blowing machine, a rotary mold carriage comprising in combination a lower mold table and an upper mold table each formed with an air chamber therein, and means for maintaining a constant supply of air under pressure to said chambers.

2. In a glass blowing machine, a rotary mold carriage comprising in combination a lower mold table and an upper mold table each formed with an air chamber therein, means for maintaining a constant supply of air under pressure to said chambers, molds on said tables, and means to convey cooling air from said chambers and direct it against the molds.

3. In a glass forming machine, a mold carriage comprising upper and lower sections relatively adjustable vertically, each of said sections formed with an air chamber, and a hollow post comprising telescoping sections connected respectively to the said carriage sections and providing an air passage between said chambers.

4. In a glass forming machine, the combination of a rotary mold carriage comprising upper and lower sections, means for adjusting one section up and down relatively to the other, and telescoping posts uniting said sections.

5. In a glass blowing machine, the combination of a blank mold and a finishing mold separate and spaced from one another, the finishing mold being entirely above the blank mold, a carriage on which the molds are mounted, a neck mold beneath and in register with the blank mold, means to open the blank mold leaving a bare blank of glass supported in and projecting upwardly from the neck mold, and means to invert the blank by an upward swinging movement of the neck mold about an axis having a fixed position relative to the carriage by which the blank is carried upward and brought to a vertically depending position to be received in the finishing mold, said axis being at a higher level than the neck mold at the blank forming station and at a lower level than the neck mold at the completion of said upward swinging movement.

6. In a glass blowing machine, the combination of a blank mold and a finishing mold separate and spaced from one another, the finishing mold being entirely above the blank mold, a carriage on which the molds are mounted, a neck mold beneath and in register with the lower end of the blank mold, means to open the blank mold leaving a bare blank of glass supported in and projecting upwardly from the neck mold, and means to swing the neck mold upwardly about an axis having a fixed position relative to the carriage, to a position above and in register with the finishing mold and thereby invert the bare blank and carry it upward into position to be enclosed in the finishing mold, said axis being at a higher level than the neck mold at the blank forming station and at a lower level than the neck mold at the completion of said upward swinging movement.

7. In a glass forming machine, the combination of a mold carriage, a blank mold to receive and form a parison of glass, and means to revolve the bare parison upward about a horizontal axis having a fixed position relative to the carriage, said axis being above the upper end of the blank mold, and thereby carry the parison upward to a level above that of the blank mold and simultaneously invert it, said axis being below the lower end of the parison when the latter is in its inverted position.

8. In a glass forming machine, the combination of a mold carriage, an inverting frame carried thereby, a neck mold on said inverting frame, means to form a blank of glass and leave it supported in the neck mold and projecting therefrom toward the axis of said inverting frame, and means to rotate the frame about said axis and thereby invert the blank.

9. In a glass forming machine, the combination of a blank inverting frame mounted to swing about a horizontal axis, means to support a blank of glass on said frame at a point beneath said axis with the blank projecting upward toward the axis, and means to swing the frame upward about said axis and thereby carry the blank upward to an inverted position above the axis.

10. The combination of a rotary mold carriage, a blank mold open at its upper end to receive a charge of glass, a neck mold beneath and in register with the blank mold, an inverting frame on the mold carriage on which the neck mold is mounted, means to open the blank mold leaving a blank of glass supported by and projecting upward from the neck mold, and means to rotate the inverting frame and thereby carry said neck mold and blank upward to an inverted position.

11. The combination of a rotary mold carriage, a blank mold open at its upper end to receive a charge of glass, a neck mold beneath and in register with the blank mold, an inverting frame on the mold carriage on which the neck mold is mounted, means to open the blank mold leaving a blank of glass supported by and projecting upward from the neck mold, said inverting frame being mounted for rotation about a horizontal axis perpendicular to the radius of the mold carriage, and means for swinging said frame with the blank thereon, outward and upward

about said horizontal axis to an inverted position.

12. In a glass blowing machine, the combination of a rotary mold carriage, an annular series of blank molds thereon, an annular series of finishing molds mounted on the carriage above the blank molds, transfer devices pivoted to the mold carriage for movement about stationary horizontal axes located between said blank and finishing molds, and means controlled by the movement of the mold carriage to automatically swing said devices upwardly in succession and cause them to transfer blanks of glass from the blank molds to the finishing molds, the finishing molds when in position for receiving the blanks being nearer the axis of the carriage than the blank molds.

13. In a glass blowing machine, the combination of a rotating mold carriage, an annular series of blank molds thereon, an annular series of finishing molds mounted on the carriage above the blank molds, the finishing molds being nearer the axis of the mold carriage than the blank molds and radially aligned with the latter, blank carrying devices supporting the outer ends of the blanks and pivotally mounted on the mold carriage with their axes located between said blank and finishing molds, and a stationary cam for swinging said blank carrying devices upwardly and thereby transferring the bare blanks from the blank molds into the finishing molds.

14. In a glass blowing machine, the combination of a mold carriage, means to rotate it, said carriage comprising a blank mold table and a finishing mold table above the blank mold table, blank molds and finishing molds supported on said tables respectively, blank transfer devices on the mold carriage each including a neck mold pivoted to the carriage for swinging about a stationary horizontal axis located between said blank and finishing molds, and means controlled by the movement of the mold carriage to swing the transfer devices about their axes and cause each neck mold to register alternately with a blank mold and a finishing mold.

15. In a glass blowing machine, the combination of a mold carriage, means to rotate it continuously, blank molds thereon, finishing molds thereon above the blank molds, transfer devices mounted to rotate with the mold carraige and pivoted thereto for swinging about stationary horizontal axes located between the blank and finishing molds, and means controlled by the movement of the mold carriage to swing the transfer devices upwardly about their axes and cause them to transfer glass from the blank molds to the finishing molds.

16. In a glass blowing machine, the combination of a rotary mold carriage comprising an annular chamber, means to maintain air under pressure within said chamber, an annular series of sectional molds, hollow arms carrying the mold sections, hollow pivot rods mounted on the carriage and opening into said chamber, and means for directing air through said pivot rods and arms for supplying air to the molds.

17. In a glass forming machine, the combination of a sectional mold, arms carrying the mold sections and mounted to swing about a common axis for opening and closing the mold, a blow head, and means to swing the blow head about said axis into and out of register with the mold.

18. In a glass forming machine, the combination of a sectional mold, arms carrying the mold sections and mounted to swing about a common axis for opening and closing the mold, a blow head, a rock-arm carrying said head and mounted to swing about said axis, automatic means to rock said rock-arm and swing the blow head into a position over the mold while the mold sections are closed, and means carried by said rock-arm for moving said head into and out of engagement with the mold.

19. In a glass forming machine, the combination of a sectional mold, arms carrying the mold sections and mounted to swing about a common axis for opening and closing the mold, a guide for directing charges of glass into the mold, and automatic means to swing the guide about said axis into and out of register with the mold.

20. In a glass forming machine, the combination of a sectional mold, arms carrying the mold sections and mounted to swing about a common axis for opening and closing the mold, a mold closing head, a guide for directing charges of glass into the mold, and automatic means to swing said guide and head about said axis and bring them alternately into alignment with the mold.

21. In a glass forming machine, the combination of a sectional mold, arms carrying the mold sections and mounted to swing about a common axis for opening and closing the mold, a mold closing head, a guide for directing charges of glass into the mold, said guide and head being connected to swing as a unit, and automatic means to swing them about said axis to bring them alternately into cooperative relation to the mold.

22. In a glass forming machine, the combination of a sectional mold, arms carrying the mold sections, a pivot rod on which said arms are mounted, a rock shaft concentric with said pivot rod, a mold closing head connected to said rock shaft, a guide for directing charges into the mold, said guide also connected to said rock shaft, and automatic means to rock said shaft and move the said head and guide alternately into position over the mold.

23. In a glass blowing machine, the com-

bination of a finishing mold and a blank mold separate and spaced from each other, the blank mold being entirely beneath said finishing mold, a transfer device, a neck mold carried thereby, and means operable to actuate said transfer device and cause said neck mold to register alternately with the lower end of the blank mold and the upper end of the finishing mold.

24. In a glass blowing machine, the combination of an inverted blank mold, an upright finishing mold mounted above the blank mold, said molds being in the same plane radial to the vertical axis of the machine, a neck mold beneath and in register with the blank mold, a transfer device carrying the neck mold and mounted to swing about a horizontal axis, said axis located intermediate of the blank and finishing mold positions, and means to actuate said transfer device and cause the neck mold to register alternately with the blank mold and finishing mold.

25. In a glass blowing machine, the combination of a blank mold to which a charge of glass is supplied, a transfer device mounted to swing about a stationary horizontal axis above the blank mold, a neck mold mounted upon said device beneath and in register with the blank mold and supporting the end of the blank remote from said axis, and means to open the blank mold leaving a bare blank projecting upward from said neck mold, the free end of said blank projecting upward to a position substantially nearer to said axis than the neck mold.

26. In a glass forming machine, the combination of a blank-forming mold, a separate finishing mold entirely above and spaced from the blank mold, a carriage on which said molds are mounted, mechanism for transferring a glass blank from the blank-forming mold to the finishing mold including a neck ring supporting the blank, and means for swinging the neck ring around a horizontal axis having a fixed position relative to the carriage, said axis being at a higher level than the initial position of said neck ring, and terminating the swinging movement of said neck ring at a position above the level of said axis.

27. In a glass forming machine, the combination of a blank-forming mold, a separate finishing mold entirely above and spaced from the blank mold, a carriage on which said molds are mounted, mechanism for transferring a glass blank from the blank-forming mold to the finishing mold including a neck ring arranged to support the blank neck end down, and means to swing the neck ring about an axis having a fixed position relative to the carriage, to bring said blank to an upright position at the finishing station, the axis of said swinging movement being above the level of the neck ring at the blank-forming station and below the level of the neck ring at the finishing station.

28. In the manufacture of glassware, the method of transferring a glass blank from a blank-forming mold to a finishing mold that comprises supporting the bare blank at one end, inverting the bare blank while thus supported, by swinging it about a horizontal axis located at a greater distance than the free end of the blank from said supported end, said swinging movement being in an arc extending transversely of the axis of the blank, and arresting the blank in position to be enclosed in the finishing mold, thereby causing the momentum of the blank developed by the inverting movement, to apply to the blank a force counteracting any distortion of the blank laterally caused by the action of gravity thereon during the inverting movement.

29. In the manufacture of glassware, the method of transferring a glass blank from a blank forming mold to a finishing mold that comprises reverting the bare blank from the neck down position at the blank mold station to upright position at the finishing mold station by force applied laterally to the neck end thereof, arresting the blank at the upright position causing the momentum of the blank to apply a force laterally to the blank in a direction relative to the axis of the blank opposite to that in which gravity tends to distort the blank during the reverting movement to thereby eliminate lateral distortion of the blank.

30. In the manufacture of glassware, the method of transferring a blank from a blank-forming station to a finish-blowing station, which comprises swinging the blank from the blank-forming station to the finish-blowing station, the center of the area of thrust applied to the blank being disposed outside of the arc described by the center of gravity of the blank.

31. In the manufacture of glassware, the method of transferring a blank from a blank-forming station to a finish-blowing station, which comprises swinging the blank from the blank-forming station to the finish-blowing station, the length of the radius of swing drawn to the center of gravity of the blank being of less length than the radius of swing drawn to the center of the area of application of the impelling force.

32. Transfer mechanism for glass-blowing machines, comprising a neck ring mounted for swinging movement, around a horizontal axis, between a blank-forming station where said neck ring is below the level of said axis of swing and a finishing station where said neck ring is above said axis of swing.

33. The combination with a glass working apparatus embodying a blnak-forming station and a finish-blowing station, of transfer means mounted for swinging movement between said stations for transferring blanks

from the blank-forming station to the finish-blowing station, said transfer means being adapted to apply the impelling force to the blank outside of the arc described by the center of gravity thereof during the transferring operation.

34. The combination with a glass working apparatus embodying a blank-forming station and a finish-blowing station, of transfer means mounted for swinging movement between said stations for transferring blanks from the blank-forming station to the finish-blowing station, said transfer means being adapted to apply an impelling thrust to the blank, and the area of application of said thrust being disposed outside of the arc described by the center of gravity of the blank.

35. In a glass blowing machine, the combination of a rotary mold carriage, a blank mold thereon, a finishing mold thereon about the blank mold, and a neck mold pivoted to the carriage for oscillation about an axis located between the blank and finishing molds to positions above and below the finish and blank molds, respectively.

36. In a glass blowing machine, the combination of a rotary mold carriage, a blank mold thereon, a finishing mold thereon, said finishing mold being located above and nearer to the axis of the mold carriage than the blank mold, and a neck mold pivoted to the mold carriage for movement about a stationary axis located between the blank and finishing molds, said neck mold moving in an arc terminating beyond the lower and upper ends of the blank and finishing molds.

37. In the manufacture of glassware, the method of transferring a glass blank from a blank-forming station to a finish-blowing station which comprises inverting the blank by a force applied to the end of the blank on a line of action such that the center of gravity of the blank is between the line of action of the impelling force and the center of reversion, and causing the momentum developed by the reverting movement to operate as the inverting movement is completed, to counteract lateral distortion of the blank caused by the action of gravity during the reverting movement.

38. Apparatus for shaping hollow glassware, comprising a blank mold and a blow mold mounted in fixed spaced relation relative to each other, means for opening and closing said molds independently of each other, means for shaping parisons in said blank mold, means for blowing the parisons for final form in said blow mold, and a neck mold mounted for swinging movement about a horizontal axis located between said blank mold and said blow mold for transferring parisons from a position in the former in which the neck portion of said parison is below the level of said axis to a position in the latter in which said neck portion is above the level of said axis.

39. In the manufacture of glassware, the method of transferring a blank from which the body portion only of the blank-forming mold has been removed from a blank-forming station to a finish-blowing station, which comprises swinging the blank about an axis spaced from and extending transversely to the longitudinal axis of said blank from the blank-forming station to the finish-forming station, the length of the radius of swing drawn to the center of gravity of the blank being of less length than the radius of swing drawn to the center of the area of application of the impelling force.

40. In a machine for blowing glass articles, the combination with a blank mold and a finishing mold, of apparatus for transferring a blank from the blank mold to the finishing mold, comprising a carrier mounted for pivotal movement on a horizontal axis, a member extending from said carrier and offset with respect to the axis thereof, and a support mounted on said member and spaced horizontally and vertically from said axis, said vertical spacing being at least half the length of the blank mold, said support being constructed and adapted to support a blank at one end with the free end of the blank nearer to said axis than is said supported end.

41. In a machine for blowing glass articles, the combination with a blank mold and a finishing mold, of apparatus for transferring a blank from the blank mold to the finishing mold, comprising a neck ring carrier mounted for pivotal movement on a horizontal axis, a member extending from said neck ring carrier and offset with respect to the axis thereof, and a neck ring carried by said member and spaced horizontally and vertically downward from said axis, said vertical spacing being at least half the length of the blank mold, said neck ring being arranged to support a parison of glass at one end with the opposite end nearer to said axis than is the neck ring.

42. In a machine for blowing glass articles, the combination with a blank mold and a finishing mold, of apparatus for transferring a blank from the blank mold to the finishing mold, comprising a neck ring carrier mounted for pivotal movement on a horizontal axis, a member extending from said neck ring carrier and offset with respect to the axis thereof, and a neck ring carried by said member and spaced horizontally and vertically downward from said axis, said vertical spacing being at least half the length of the blank mold, said neck ring being arranged to support a parison of glass at one end with the opposite end nearer to said axis than is the neck ring, said neck ring having a neck-forming cavity and having an opening communicating with said cavity for the admission of air.

43. Glass blowing apparatus comprising an inverted blank mold adapted to form an inverted blank, a finishing mold adapted to receive an upright blank, and transfer mechanism for transferring blanks from said blank mold to said finishing mold while the blank mold retains its inverted position, said transfer mechanism comprising a neck ring carrier mounted for pivotal movement on a horizontal axis, said molds being on opposite sides of said axis and spaced therefrom with the finishing mold at least as high as the blank mold, a supporting member extending from said neck ring carrier and offset with respect to said pivotal axis of said carrier, and a neck ring mounted on said supporting member and in register with said blank mold, said neck ring being below said axis and adapted to support an inverted blank after said blank is released from said blank mold with the blank projecting upward from the neck ring, and means to swing said carrier on its axis and thereby move the neck ring in an arc concentric with said axis from said position in register with the blank mold to a position to register with the finishing mold, said neck ring having a finish-forming cavity, and also having an opening communicating with said cavity for the admission of air.

Signed at Toledo, in the county of Lucas and State of Ohio, this 26th day of December, 1922.

LEONARD D. SOUBIER.